

# SCIENCE.

FRIDAY, MAY 1, 1885.

## *THE APRIL MEETING OF THE NATIONAL ACADEMY OF SCIENCES.*

THE spring meeting of the national academy always secures a larger attendance of members than that held in the autumn, because the business of this stated session, including the election of new members, is more important. Last week, however, the attendance was not so good as usual, only thirty-seven members being registered. Of these, seventeen were from Washington, and the remainder principally from Philadelphia, Baltimore, New Haven, and Cambridge. Though lacking in special incident, the meeting was an interesting one; both scientific and business sessions extending over four days, and the papers eliciting a good share of discussion. Public and private receptions were not wanting, and the mid-day recess gave excellent opportunities for social intercourse. Though many questions affecting the policy and the development of the academy were discussed with great freedom at the business-meeting, these discussions were not marred by a single note of discord.

The trust funds of the academy having been increased during the year by the gift of eight thousand dollars from the widow of the late Professor Lawrence Smith, and in his memory, to encourage the study of meteoric bodies, Messrs. Wolcott Gibbs, Brush, Asaph Hall, Pumpelly, and Rutherford were appointed a permanent committee to administer the trust; and they were also charged with the duty of conveying to Mrs. Smith the thanks of the academy, and its appreciation of her generosity. The award of the Draper medal, made for the first time, was most appropriately bestowed on Prof. S. P. Langley of Allegheny, now absent in England, for his researches and discoveries in solar radiation.

The academy was strengthened by the elec-

tion of five new members: Prof. E. S. Holden, director of Washburne observatory, Madison, Wis., the chief of the recent Caroline Island eclipse expedition; Professor Henry Mitchell of the U. S. coast-survey, whose knowledge of the hydrography of our eastern coast is unsurpassed; Mr. F. W. Putnam, the curator of the Peabody museum of American archaeology at Cambridge; Prof. W. A. Rogers of the Harvard observatory; and Mr. Arnold Hague of the U. S. geological survey, whose work has lain chiefly in our western territories. As the number of home members is now ninety-eight, it is probable that by another year it will reach a hundred, beyond which it will be difficult to pass, on account of the more stringent rules of admission which will then come into force.

We have only space to mention a portion of the papers, a complete list of which will be found in our notes. Jupiter was the subject of two astronomical papers. Prof. C. A. Young called attention to some changes in the constitution of the 'great red spot,' and to the belt of white spots in the southern hemisphere. The period of one of the latter, the upper of a lozenge-shaped series of four, he had found to be 9 h. 55 m. 12.74 s., and that of an equatorial white spot 9 h. 50 m. 9-12 s., while that of the great red spot was now 9 h. 55 m. 13.4 s. Mr. G. W. Hill discussed the two inequalities in the moon's motion due to the action of Jupiter, the theoretical discovery of which is due to Mr. Neison, finding the coefficients for these inequalities smaller than given by Neison; the former's values being  $-1.163''$  and  $+2.200''$ , while Mr. Hill obtained  $-0.903''$  and  $+0.209''$ . In a paper on the cause of the progressive movement of areas of low pressure, Prof. E. Loomis concluded, that, although in middle latitudes these areas usually follow the course of the winds, the general drift of atmospheric movement could not be looked upon as the cause. Their

progress could be compared to that of a great atmospheric wave, the pressure being more steady and persistent on the one side (in this case the west) than on the other. Prof. H. A. Rowland exhibited a tabular view of the different values which had been given to the ohm, and criticised that which had received the sanction of the Paris electrical conference as an average derived by giving equal weight to values obtained by admittedly unequal methods. By adding to the table of the Paris conference the results reached by the American committee in its investigations, and allowing each result its proper proportional value, he had obtained a column of mercury of one square millimetre section and 106.2 centimetres high as a satisfactory average, which the American committee therefore recommends.

Perhaps the greatest public interest attached to the two papers of Dr. Graham Bell, given on the last day of the session, one on the possibility, while at sea in a fog, of detecting by means of echoes the proximity of dangerous objects. Mr. Della Torre and Mr. Bell had experimented by means of a gun and a receiving-trumpet, and had obtained echoes from passing vessels at a distance of from a quarter of a mile to a mile, according to their size. The other showed the results of some experiments he had made on the audition of school-children of Washington. He exhibited an audiometer he had devised, in which two flat coils of insulated wire were so adjusted as to admit of separation on a graduated scale measuring the distance between their centres. An electrical current, produced by the rotation of a Siemens armature between the poles of a permanent magnet, is passed through one of the coils, and is rapidly interrupted by the rotation of a disk, a telephone being attached to the other. The intensity of the sound produced being dependent upon the intensity of the current induced in the coil to which the telephone is attached, and this upon the distance between the coils, a ready measurement of audition is obtained. The use of this instrument proved that ten per cent of the more than seven hundred pupils examined with the

assistance of Mr. H. G. Rogers were hard of hearing (in their best ear), and seven per cent had very acute powers; the general range of audition being measured on the scale by the separation of the disks to a distance of from fifty to eighty centimetres, while the total range was from twenty to ninety centimetres. It is known, on the other hand, that in some institutions for the deaf as many as fifteen per cent are merely hard of hearing.

Dr. Ira Remsen brought to the notice of the academy a case in which chemical action was affected by magnetic influence. Placing a test-tube containing nitric acid in the middle of a coil through which a current was made to pass, he found that the action of the acid on a strip of iron placed in it was sensibly lessened, by at least ten per cent, when compared with that of another strip of iron placed in similar circumstances excepting for the absence of the electric current. Dr. Sterry Hunt proposed a classification of the natural silicates which make up a large part of our earth's crust, dividing them into three groups, according to their bases, and distinguishing them as proto-silicates, persilicates, and protopersilicates. These divisions he believed were more natural than those which divided them according to their sensible qualities, or otherwise, and indicated genetic distinctions.

On the biological side, the papers, while perhaps not so attractive to the public as those already mentioned, were of more than usual philosophic interest. Prof. E. D. Cope, in a communication on the pretertiary vertebrates of Brazil, which were referred to the cretaceous, Jurassic, and upper paleozoic, and which contained many interesting types, pointed out also that a single pliocene fauna extended from south of our borders to Patagonia, and that neither eocene nor miocene beds had been discovered in South America. In a more elaborate paper on the phylogeny of the placental mammalia, based largely on discoveries in the western parts of North America, he claimed, that while many details remain to be worked out, and though their didelphian ancestors had

not yet been discovered, the phylogeny of the orders of placental mammals was now undoubtedly completed in its main features. The phylogeny of the clawed groups has been traced back to a common ordinal form, the Bunotheria, and that of the hoofed groups to the contemporaneous order, Condylarthra; while at the same time the characters of the feet of the Condylarthra agree with those of clawed placental mammalia, and bind the series together; the anthropoid line may also be traced directly through the lemurs to the Condylarthra. These views were fortified by numerous examples. Mr. S. H. Scudder gave a sketch of the geological development of the orders of winged insects, in which he claimed that no ordinal differentiation could be detected in paleozoic insects, although all the existing orders were fully developed by the middle of the mesozoic period: he therefore held that we were to look to the triassic period for the most interesting future discoveries in this field. Dr. T. Gill exposed his latest views regarding the orders of fishes, and introduced a speculative paper, by Dr. Ryder, on the flukes of whales, which he looked upon as the posteriorly transferred, hypertrophied, tegumentary elements of the mammalian hind-legs, basing his argument on embryological evidence, and on the anterior transference of the front limbs and girdle in certain mammalia. Dr. J. S. Billings exhibited a series of composite photographs of skulls, and explained the method pursued in taking them directly from the skull; as also a method of measuring the cubi capacity of crania, devised by Dr. Matthews. This consisted briefly in the rapid use of water instead of shot or seed, after rendering the skull water-tight by closing all the small openings with putty, spraying the interior with thin varnish, and embedding the whole skull in putty. Finally, Major Powell read a paper on the organization of the tribe, and the differentiation of kinship, distinguishing between agnatic kinship, founded upon brother groups, and enatic kinship, founded upon sister groups.

The next meeting of the academy will be held in Albany, beginning Nov. 10.

## LETTERS TO THE EDITOR.

\*.\* Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

### Mr. Hampden's designation of Sir Isaac Newton.

ON p. 283 of *Science* (April 3) it is stated that "to call Sir Isaac Newton 'a fanatical pantheist' is a happy thought which would certainly not have occurred to everybody." I trust I shall not incur the risk of identification with the disciples of Mr. John Hampden if I venture to express my conviction that this gentleman does not vituperate Newton when he applies to him a term at once appropriate and just. Surely, if such were my opinion, I should be justified in asserting that the *scholium generale* at the end of the third book of the 'Principia' reads like the drivel of a cretin rather than a scientific conclusion. While science itself forms a grand and sublime whole,—its only rival and superior being pure reason and sense,—it is nevertheless true that nothing can be more disappointing than many of the biographies of physicists, who, even in the most favorable instances, are but little great men. In Locke's correspondence with his nephew Sir Peter King, we perceive what a delicate matter it was to have anything to do with Newton in connection with their precious mutual confidences with respect to the mystical and prophetic parts of the New Testament. Hitherto Sir Isaac's devotion—I may add, fanatical devotion—to theology has never been called in question. His laborious criticism of Dr. Burnett's 'Sacred theory of the earth' deserves a place among other kindred examples of human folly and irrational superstition, its object being to prove that the surface of the earth afforded indubitable evidences of the truth of the Bible account of creation.

M. C. O'BRYNE.

Highlands, Macon county, N.C.,  
April 17.

### A second phalanx in the third digit of a carinate-bird's wing.

There is not a single adult carinate-bird known bearing two phalanges at the third digit. Jeffries (*Proc. Bost. soc. nat. hist.*, xxi. 301-306) gives the following four families of birds having two phalanges in the first, three phalanges in the second, and one phalanx in the third digit: the Palamedeae, Anseres, Alektorides, and Pygopodes. The only living bird which has two phalanges in the third digit is the ostrich from Africa (Alix). According to Meckel (*Archiv. anat. phys.*, 1830, 233) and Nitsch (*Osteogr. beitr. naturg. vögel*, Leipzig, 1811, 90), the ostrich possesses only one phalanx in the third digit. The only known bird having four phalanges in the third digit is *Archaeopteryx* (Dames) from the lithographic limestone.

It is evident that all birds at a former time had four phalanges in the third digit; and it seemed very probable to me that rudiments of at least one phalanx more than in the adult ought to be found in embryos of the above four families. This probability has been verified by the examination of an embryo of *Anas domestica* L. (length of ulna 2.5 mm.), where I find a rudiment of a second cartilaginous phalanx in the third digit.

I think it not improbable that the rudiment of a third phalanx (if there is really a second one in the third digit) will be found in embryos of the ostrich, which I hope soon to examine.

DR. G. BAUR.

Yale-college museum, New Haven;  
Conn., April 24.

### THE RUSSIAN BASE OF OPERATIONS AGAINST INDIA.

At Baku, on the Caspian Sea, there stands an old temple, where for centuries a beacon has been kept continually burning by the fire-worshippers of India and Persia. The priests in the olden time declared that the light was supernatural, the gift of the god of fire. Modern science shows that the supply comes from gas-wells. On one side of this temple are derricks and oil-wells; on the other side, a great stone embankment stretching for over a mile along the seacoast, several hundred steam and sailing vessels, long trains of railroad-cars loading with oil, and a population of fifty thousand where ten years ago were less than fifteen thousand. The Parsee, tending his eternal fire, is the emblem of the past: the Russian, with his oil-wells and embankments, his railroads and steamboats, is the emblem of the present.

From Baku, steamers run north, through the Caspian Sea, to Astrakhan, near the mouth of the Volga; thence up the Volga and Kama to Perm (25 miles by rail from Ekaterinburg in Siberia, whence come the best iron rails and manufactures of iron and steel), up the Volga and the Olga to the neighborhood of Moscow, up the Volga to Rybinsk, whence a canal continues the navigation to the Baltic. On these waters the cotton from Khiva and Bokhara, the oil from the Caspian, the wool from Astrakhan, and the grain from the lower Volga, are borne to the Baltic and the North seas, while material and supplies from all parts of Europe are brought as return cargo. Some of the steamers plying on the Volga resemble our Mississippi steamers, and are as large and commodious: others, two hundred feet long, are fitted with cisterns, into which the oil flows, through pipes from reservoirs at the refineries, at the rate of from a hundred to two hundred tons an hour. Kerosene from Baku has nearly superseded the American oil in Russia, and now competes with it in Berlin and Vienna. From Baku the railroad runs west (561 miles in thirty-six hours), along the foot of the Caucasus Mountains, through Tiflis, to Poti

The map published in the present number, to accompany this and other articles, is based upon one issued from the office of the superintendent of the great trigonometric survey of India. The original was mapped on the bases of the surveys made by British and Russian officers up to 1881, and was published in Dehra Dun in September, 1881. As slightly reduced here, it represents the territory on a scale of an inch to forty miles. The upper broken red line represents the boundary of the territory in dispute as given on the map of which this is the copy; and it also appears in precisely the same place, in the latest reduction of the Russian staff map obtainable in St. Petersburg two years ago; but the lower broken red line indicates what is supposed to be the extreme Russian claim, and does not appear on the original from which the map is taken.

and Batum on the Black Sea. From these seaports, Russian steamers, the best on the Mediterranean and Black seas, make quick trips to Sebastopol and Odessa; and railroads connect these cities with all parts of Russia, eastern and western Europe. Directly across from Baku (sixteen hours by steamer), on the other side of the Caspian Sea, the trans-Caspian railroad commences, runs to Askabad (280 miles), and is being rapidly extended towards Sarakhs (185 miles from the present terminus). From Sarakhs to Herat is about 200 miles up the river Hari Rud, or Tajand. The construction of a railroad would be more difficult between these places than between Sarakhs and the Caspian Sea; though, as it must follow the line of the river, there would be no obstacles that cannot be easily surmounted.

Sibi is the present terminus of the Indian railways, though the English government is extending the line 135 miles to Quetta, 470 miles from Herat by the way of Kandahar. This route crosses many rivers and mountain ranges, and will be a difficult and expensive road to build. It requires twice as long for the transit of men and supplies from Sibi to Herat as from Herat to Baku, though the distance is but little more.

The Caspian line is the most feasible and shortest route for a railroad from Europe to India.

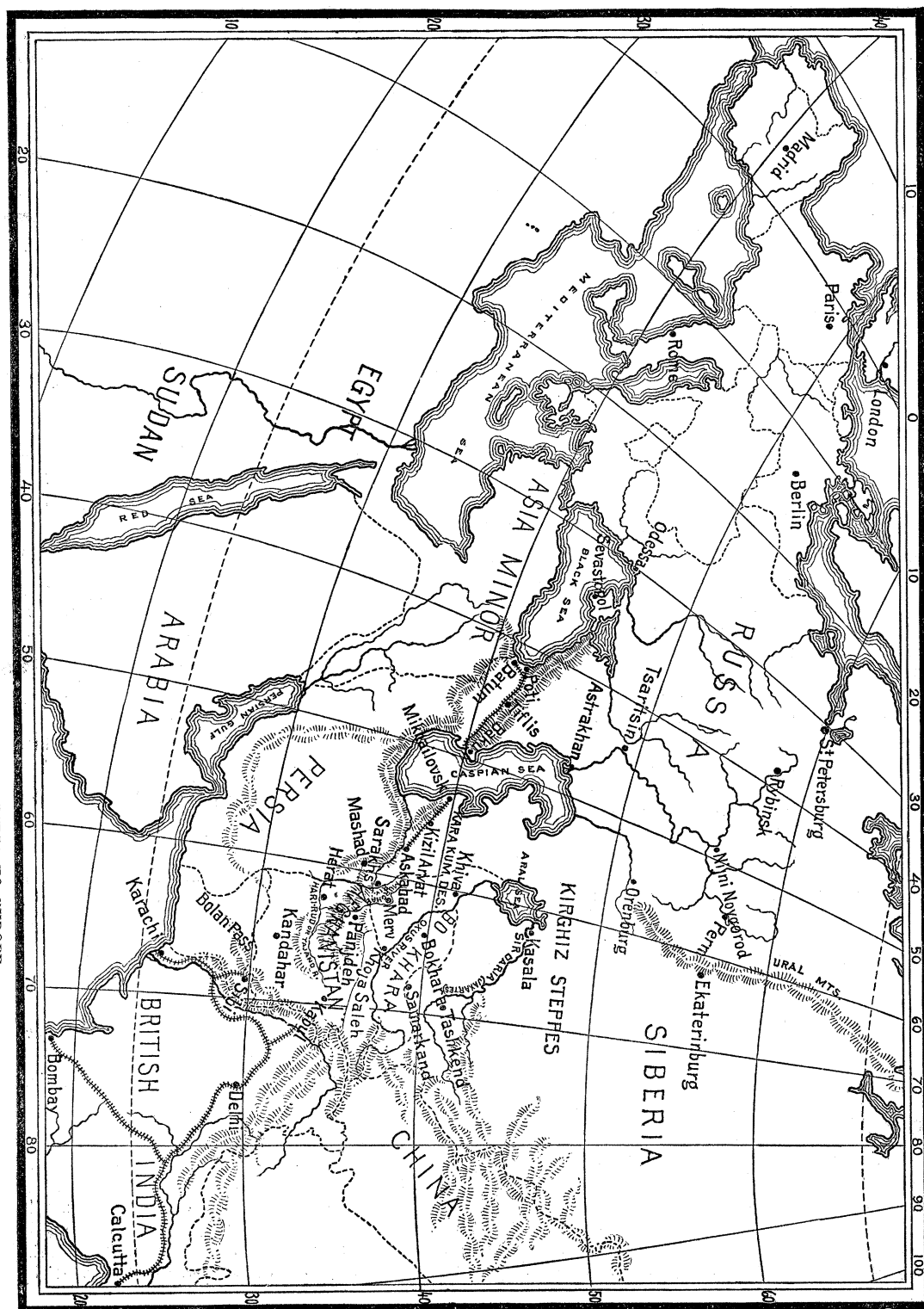
	Hours.
From London to Berlin . . . . .	24
Thence by Breslau and Lemberg to Odessa . . . . .	48
By steamer to Batum . . . . .	48
By rail to Baku . . . . .	24
By steamer across the Caspian . . . . .	16
By rail to Askabad . . . . .	12
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From London to Askabad <sup>1</sup> (7 days) . . . . .	172
Thence to India, 1,000 miles, in . . . . .	40
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Nine days' running time, if the railroad were in operation, from London to India . . . . .	212

While from London to Herat, by the Suez Canal and India, is nearly three times as long.

The trans-Caspian railroad, from the Caspian to Sarakhs, runs in a south-easterly direction, at the foot of a long range of mountains separating Turkestan from Persia. Small streams, every few miles, run down the sides of the mountains into the valley, and are soon lost in the sands of the desert. Wherever these streams appear, there are fertile oases. This desert extends from the foot of these mountains, north-east to the River Oxus, about 500 miles at the Caspian Sea, and 300 miles at

<sup>1</sup> Here ends the present line of railroad.

MAP TO SHOW THE RELATION OF CENTRAL ASIA AND INDIA TO EUROPE.



Sarakhs. The rivers Tajand and Murgh-áb run from the mountains of Afghan into the south-western part of the desert, nearly parallel to the Oxus, until they are absorbed by the sands of the desert. The old channels through which they once ran into the Oxus can still be traced. Formerly this desert was a rich, fertile land, cultivated by irrigation, inhabited by a vast population, where for hundreds of miles "a nightingale could fly from branch to branch of the fruit-trees, and a cat walk from wall to wall and housetop to housetop." The monuments of the old cities are frequently seen by the traveller, half buried in the sand. Now the desert is traversed only by a few wandering horsemen, or an occasional shepherd with his flocks, and is sparsely inhabited on the few oases that have been preserved.

The great cities of Turkestan are Khiva on the Oxus; Bokhara, Samarkand, and Tashkend, north of it. The former route from Russia to these cities was by rail to Orenburg on the dividing-line between Europe and Asia (and the termination of the Russian railways), thence across the desert to Kasala on the Aral Sea, then by steamer up Sir Daria (the Jaxartes) or through the Aral Sea, and up the Amu Daria (the Oxus). These rivers are navigable only at their flood, and are very dangerous even for the smallest steamers. At other seasons the route is all the way across the desert. It is 900 miles from Orenburg to Khiva, 1,100 to Bokhara, and 1,225 miles to Samarkand, and takes fifty days for the caravans to go from Orenburg to Samarkand. A few years ago this route became for a time impassable, owing to frequent incursions of robber-bands. A trader from Khiva, bound to the great fair at Nijni Novgorod, was compelled to find some other route: he crossed the desert from Khiva to the Caspian Sea (500 miles), and found it easier and quicker than from Khiva to Orenburg. Here he took the Baku steamer up the Volga to Nijni Novgorod. Other caravans followed. The Russian armies, with their supplies, which had been sent by the way of Orenburg and Kasala, were sent by the Caspian route. When the Caspian railway is extended to Sarakhs, Bokhara will be within 300 miles, and Merv less than 100 miles, from the line of the road.

The discovery of oil at Baku has built that city, and made it the *entrepot* of all kinds of stores; has opened a railroad from Tiflis to Baku, and created a fleet of steamers plying on the Caspian and Volga; has turned the course of the Asiatic trade from Orenburg to the Caspian, and transferred the government of Asia

from Turkestan to Tiflis; has led to the opening of the Caspian and the construction of the trans-Caspian railroad; and has brought Merv, Herat, and India forty days nearer St. Petersburg than they were six years ago, reducing, by fully three-fourths, the cost of transportation of men and supplies, and opening a new era for Asia. The great saving in time in the cost of transportation of men, munitions of war, and stores, will amply pay the interest on the cost of the road, and its operating-expenses.

England and Russia could easily unite in the construction and operation of the Caspian road. They have a common interest, — the shortest way to their respective dominions. The cause which threatens conflict between these two powers on the borders of Afghanistan should be the occasion of peace. England wants on the west of India a strong and permanent power, such as Afghanistan can never be, although supported by constant subsidies, supplemented, when these failed, by an armed force. Russia, on her eastern boundary, also needs a strong and permanent power to restrain the wandering tribes from despoiling her territory.

The English complain that the policy of Russia for a hundred years has been to extend her dominions in every quarter, and in proof point to the continual expansion of her territory. Scarcely a century ago the eastern and southern boundaries of Russia followed the Volga down to Tsaritsin, about three hundred miles from the Caspian, then crossed to the Don, following that river to the Black Sea. Since then the Russian army has crossed the Caucasus, conquered the whole of Circassia and a portion of Persia and Turkey in Asia, and pushed its southern boundary two hundred miles south of the Caucasian Mountains. It has pushed its south-eastern boundary down to the Caspian, around the head and eastern shore of that sea, reaching out to the Sea of Aral, annexing Khiva, Bokhara, Turkestan, and the Kirghiz Steppes, even to the western boundary of China. Quite recently it has annexed Merv, and threatens Herat; and now, from the Black Sea and Persia north to the Arctic Ocean, the Russian eagle is the only flag that waves.

Russia, again and again, through her leading statesmen, has assured England that she had reached her eastern limits, and as often have these assurances been contradicted by further conquests in the east. The English naturally regard these assertions as promises made only to deceive, and to be broken as soon as the hostile feeling of Great Britain, aroused by

such conquests, has been quieted. May not, however, the intentions of the Russians be honest, and the cause of this apparent breach of faith be easily explained?

All the country from the Don and the Volga east to China and India, and from the Caucasus south to the Persian Gulf, and south-west to the Mediterranean, has been occupied on the one side by wandering tribes without fixed habitation or permanent government, marauders, slave-dealers, and vagabonds; while on the south and south-west the countries have been and are ruled by the Persians and Turks, whose dominion is a constant curse to the people over whom they rule, the tax-gatherers being the only evidence to them of a government.

Wherever the Russians have established a new eastern boundary, settlements have sprung up. These settlements must be protected from pillage by the wandering chiefs. It was not sufficient to chastise the marauders and return within the boundary, as the return was regarded as a retreat, and proof of weakness. Experience has taught the Russians, that, in order to keep peace, these tribes must be brought under Russian rule: thus, by force of circumstances, they have been compelled to extend their territory from time to time. The conquered countries have been governed by the ablest generals of Russia, a Kaufmann and a Skobelev. Their authority was almost despotic; and frequently kingdoms have been annexed before either Russia or Europe knew of the forward movement. When once annexed, the government could not recall its army, or refrain from governing the conquered country.

The Russians are only carrying out the policy adopted by the English in India a hundred and fifty years ago. Her rule then extended only over a few tribes. Lord Clive and Warren Hastings were forced to extend her dominions north to the Himalayan Mountains, and south to the Pacific Ocean, until the whole peninsula of India became her empire; which, though not as extensive territorially as Russia, yet in wealth and population far exceeds that of Russia in Asia.

Wherever the Russian has gone, there he has carried law and government, settled habitations, and civilization. Though we may regard the civilization as crude and the government as bad, yet it is a vast improvement over the former misrule. Robbery has been stopped, slavery abolished, and the permanent cultivation of the land begun. With the exception of one or two tribes in the Caucasus, there is not a single nation or tribe that does not

greatly prefer the rule of Russia to the misrule of their former chiefs.

After the capture of Merv by the Russians, Afghan was the only country that separated the Russian dominions from the English empire. The western boundary of Afghan then became a subject of great importance to England. The capture of Merv was acquiesced in by Great Britain on the agreement with Russia that a joint commission should be appointed to "delimit the Afghan frontier from Khoja Saleh on the Oxus, to Sarakhs" on the Hari-Rud, or Tajand, — a distance of about three hundred miles.

The Russians claim that this boundary-line runs south of Panj Deh, crossing the Hari-Rud or Tajand about fifty miles below Herat, following a range of mountains that runs, or at least was supposed to run, from the Oxus River to the Tajand.

The English claim that it crosses the river about two hundred miles below Herat. The line has never been fixed. In the article on Afghanistan, in the last edition of the *Encyclopædia Britannica*, two boundaries are given. The first crosses the river about seventy miles below Herat, and follows closely the line now claimed by Russia. It says, "The half-independent Hazara tribes stretch across the branches of the river of Herat, and down into the Oxus basin, so that it is difficult here to assign a boundary."

On two maps in my French atlas, the boundary-line crosses the Tajand at different places. On the large map of the Messrs. Johnson, published in Edinburgh, two boundaries are also given; though the outer one, now claimed by England, has greater prominence. At one time the line was described as running along a high mountain range which passed south of the Murgh-áb River, and between that river and the Tajand, — substantially the line now claimed by Russia; but when it was discovered that this range existed only on the maps and in accounts of early travellers, and that there was no mountain barrier, the boundary-line was moved farther west.<sup>1</sup> Until recently, the western boundary had never been a subject of interest to the amir of Afghan or to the English or Russian governments. The land within the disputed territory is of little value. The population is sparse, with few affiliations with the Afghans. The people belong to a different race, having features of the Mongol type, speaking a different language, and pay-

<sup>1</sup> The London *Times* says, "The limits have changed according to the character and military resources of the chiefs ruling at Herat, Kabul, and Kandahar."

ing tribute to the Afghans only when compelled by an armed force. According to the *London Times*, the amir of Afghan did not occupy this disputed territory until 1883, when he received a map from the viceroy of India, with the boundary-line now claimed.

The Russians claim that the English have furnished the Afghans with maps, plans of fortifications, money to build and equip these forts, and engineers to superintend the construction, and that these acts are a breach of good faith on the part of England. The English claim that Russia has sent an armed force into the disputed territory, occupying at least two towns, and that these acts are a breach of good faith on the part of Russia.

The English policy in India has been the same as that of Russia. It was found necessary, and proved successful, to the maintenance of order; and there is every reason to believe that a similar policy will produce like results.

GARDINER G. HUBBARD.

#### ROADS FROM INDIA TO CENTRAL ASIA.

DOST MUHAMMAD, one of the most famous amirs of Afghanistan, is reported to have said that he could not understand why the masters of the riches of India ever should have designed "occupying such a country as Kabul, where there is nothing but rocks and stones." It was a shrewd remark; and Afghanistan owes its importance, not to the fertility of its soil or to any other natural advantages, but to the fact that the great trade and military routes of central Asia lie within its borders. Afghanistan — using the word in its broadest sense, as including all the territory under the rule of the present amir — takes the form, roughly speaking, of an immense square, with sides of about six hundred miles in length. On the west a well-defined boundary separates it from Persia. To the south the dividing-line between the territories of the amir and those of the khan of Kelat, as the ruler of Baluchistan is often called in English books, is not so well marked; but, as a large portion of it runs through an uninhabitable salt desert, this is not of much importance. On the east the Suliman and other mountain ranges form a natural frontier between Afghanistan and British India. At one time this mountain barrier was supposed to be impracticable for the movement of large masses of troops. To-day it is certain that such is not the case; for, in addition to the well-known Khyber, Kuram, and Bolan passes, more than two hundred other paths cross these

mountains in every direction. In fact, the barrier is no barrier at all, and would offer but little resistance to an enterprising general. It is on the north, however, that Afghanistan is most vulnerable. True, the Amu Daria or Oxus River, from its source 13,900 feet above the sea, in Lake Sir-i-Kuld, in the highland of Great Pamir, to Khoja Saleh, separates the Afghan provinces of Badakshan and Turkestan from the Russian dominions of Ferghana and Bokhara. But a river is, at best, a poor boundary, from a military point of view; and, besides, from Khoja Saleh to the Persian frontier, on the Hari-Rud, the line, wherever run, must be purely artificial.

More unfortunate still, the Hindu Kush, with its outlying spurs — the Khor-i-Baba, Safed Kur (White Mountains), and Siah Kur (Black Mountains) — running from east to west, divides Afghanistan into two unequal parts. The territory lying north of these mountains belongs, physically speaking, to the basin of the Oxus (Aralo-Caspian basin), or, in other words, to Russian Asia. In addition, these mountains, together with their off-shoots to the south, prevent, during five months in each year, all direct communication between Kabul, the chief city of the east, and Herat, the equally important emporium of the west. The main route between these two places is through Kandahar, which thus lies at the southern apex of a nearly equilateral triangle, with sides of three hundred and three hundred and thirty-five miles. The position of these places once thoroughly grasped, there is no difficulty in understanding the base of the English operations in Afghanistan.

From Karachi (Kurrachee) on the Arabian Gulf, and near the mouth of the river Indus, a railway runs along that river by Haidarabad to Sukkur. At this point it crosses the Indus, and, passing by Multan, joins the line from Calcutta and Bombay at Lahore. The latter road runs thence by Rawal Pindi, crossing the Indus near Attock, to Peshawar at the entrance of the Khyber Pass. The last of this railway-system — 'the missing link from Multan to Lahore' — was open to traffic in 1878.

Kabul, the chief political city of Afghanistan, contains a population of between fifty and sixty thousand. It is situated on the Kabul River, not far from its confluence with the Logar, and is the converging point of the trade-routes from Afghan Turkestan, and the countries beyond the Oxus, over the difficult mountain passes, eleven and twelve thousand feet high, of the Hindu Kush; from Persia and Baluchistan by Kandahar; and from India by



the Khyber and Kuram passes. From Kabul to Peshawar (190 miles), the road leads by the Khurd Kabul or Lutabad passes to the Jagdalak Pass. It was in these narrow defiles that the English army was slaughtered by the Afghans in 1842. Thence by Gandamak and Jalalabad, on the Kabul River, the road runs to Lalpura. There it leaves the river, and follows two mountain streams over the Khyber Pass (3,000 feet), to Peshawar. This route was followed by Elphinstone and Pollock in the first Afghan war; and, now that the terminus of the Punjab railway is at Peshawar, it is the most important route from India to eastern Afghanistan, although Gen. (now Sir Frederick) Roberts, in 1879, led his army over the more southern Kuram Pass to Kabul.

Kandahar, the great trade-centre of the south, lying on the direct road from India to Herat, is likely to be of more importance in case of a war between England and Russia. It is situated in a small plain between the Arghand-áb and Tarnak rivers, and commands the road through the Tarnak valley, by Ghazni, to Kabul (318 miles). Sir John Keane took this route on his march to Kandahar in 1838; Nott marched by it in 1842, to aid Pollock in avenging the massacre of Elphinstone's expedition; and it was by this road that Sir Frederick Roberts made his famous march from Kabul to the relief of Kandahar in 1880. The railroad from India to Kandahar leaves the main line from Karachi to Lahore, at Sukkur on the Indus; thence by Shikarpur and Sibi to Rindli, at the entrance of the Bolan Pass. Here the railway stops; but a good carriage-road has been constructed, at least as far as Quetta. Unfortunately no bridges were built over the streams, they being crossed by fords; and this has made it impossible to lay a light military railway along the road. Indeed, it has been stated that a thoroughly built railway could not be opened to Quetta in less than two years. Quetta, or Shal, is situated between the head of the Bolan Pass and the Pishin valley. It commands the road, and is therefore a place of very great military importance. The Bolan Pass and Quetta are in Baluchistan; but the English acquired by treaty, in 1876, the right to hold and use the pass and town for military purposes, and Quetta is now the most advanced English outpost. The road leads thence through the Pishin valley, and over the Kojak or Gwaja passes to Kandahar. From the end of the railway at Rindli, to Kandahar, is somewhere between 200 and 260 miles. Authority has been given to complete it to the Pishin valley within a hundred miles of Kan-

dahar. That city was occupied by the English from 1839 to 1842, and again from 1879 to 1881. The trade-route thence to Herat, nearly 370 miles away, leads by two strong positions, — Kushk-i-Nakud, the scene of Burrows's defeat in 1880, and Girishk, — and over several mountain passes. But the importance of this road, and of Kandahar itself, has been lessened by the discovery of a much longer, but nevertheless good, route from Quetta to Herat without passing Kandahar. It was by this road that Gen. Lumsden's Indian escort, over 1,300 strong, and with a train of 1,300 camels and 400 mules, marched at an average rate of eighteen miles a day to meet him on the frontier.

Herat (Heri) is situated on a fertile plain, near the river Hari-Rud (river of Heri or Herat), between the western extremities of the spurs of the Hindu Kush, above mentioned. Its importance, both commercial and strategic, is due to the fact that it dominates the best road from the Caspian by Mash-had, to the Indus by Kandahar. The position of the city itself, from a military point of view, is not good; because its defences are, as Gen. Grodekoff pointed out, commanded by a neighboring hill.

The Hari-Rud rises in the heart of Afghanistan, and flowing almost due west along the northern base of the Paropamisus Hills, within a few miles of Herat, strikes the Persian frontier seventy miles beyond that city, at Kusan. There it abruptly turns north, and, passing Zolfikar, — a name given to a ford, but more correctly, perhaps, to a neighboring pass in the hills, — reaches Pul-i-Khatun. At this point it receives its principal affluent, the Kashaf Rud, from the west. The Kashaf and Hari-Rud, after leaving Pul-i-Khatun, take the name of Tajand, and, passing Sarakhs, become desiccated in the Turkoman Steppe. The oasis thus formed lies between Merv and Persia, and for this reason has been nearly uninhabited until the recent Russian advance upon Merv.

The river Murgh-ab rises to the south of the Paropamisus Hills, and, flowing in a general northerly direction, passes the Afghan stronghold of Bala Murghab, on the road from Herat to Maimana and Afghan Turkestan; thence it flows by Meruchak (where, according to the Russians, the north-western boundary of Afghanistan crosses the river), by Panj Deh and Yulatan, to Merv, where it loses itself in the irrigation canals of that oasis.

A few miles below Panj Deh the Murgh-ab receives from the west the river Kushk, which rises to the north of the water-parting not far

from Herat. The road from Herat to Bala Murghab crosses its upper waters. At some point near the confluence of the Murgh-áb and the Kushk the Afghans constructed a small fort called Ak Tepe. The Merv oasis, from just above Yulatan, stretches along the Murgh-áb for nearly sixty miles. Its width is not far from forty miles, and it may be said to be only 240 miles from Herat. A detailed and interesting description of the oasis, together with a clear plan, is given in the second volume of O'Donovan's 'Merv Oasis.' It is only necessary to say here that Merv is the converging point of the caravan routes from Persia by Mash-had, to Khiva, at the northern end of the Turkoman Steppe, and to Bokhara and the countries beyond the Oxus.

EDWARD CHANNING.

#### THE RACES OF CENTRAL ASIA.

AFGHANISTAN is inhabited by many different tribes and races, of whom the Afghans are undoubtedly the dominant race; but the extent of their dominion at any one time depends more upon the skill and energy of the Afghan chief or amir for the time being, than it does upon any prescriptive right or tradition. Indeed, there are living at the present moment, in the mountainous districts, non-Afghan tribes which have never been subdued. And the Hazara dwelling on the great central plateau are only tributary to the ruler of Kabul when that potentate is sufficiently strong at home to spare soldiers to collect the tribute or taxes. There is no settled government in the country. The amir's authority is respected only when he possesses means of compelling respect. Each tribe and clan manages its own immediate affairs through a council of the elders, and in accordance with the immemorial customs of the tribe. The amir is merely a dictator for life; and every attempt, in recent times, to introduce a settled form of government or to establish a dynasty, has been an immediate and complete failure. It is this want of cohesion among the Afghans themselves that has brought about the interference of the English in their domestic and foreign relations. The true Afghan tribes live in the valleys between Kabul and Peshawar, and Kabul and Kandahar. They are a sturdy, daring people, and are described as possessing a strong Jewish cast of countenance. This latter peculiarity has induced some learned and enthusiastic ethnologists to declare that they, like all other races whose origin is unknown, are the descendants

of the ten lost tribes of Israel. However this may be, they at one time extended their rule to the south of Peshawar, and have been a constant thorn in the flesh of the viceroy of India from the beginning of the century to the present day.

To show the fluctuating nature of the Afghan dominion, let us briefly trace the history of the country from 1842 to the present year. In 1842 the English abandoned the attempt to force a ruler on the Afghans, and again recognized Dost Muhammad as amir of Kabul. Eight years later, that chieftain reconquered Balkh, then the most important town north of the Hindu Kush; and between 1850 and 1860 he extended his rule over the whole of Afghan Turkestan, and reduced Badakshan to the condition of a tributary province. In 1855 he took Kandahar, and thus established his authority in the south. But it was not until 1863 that he captured Herat. Then, for the first time since the days of Timur, there was one supreme ruler in the country. Two weeks later he died. His son, Shir Ali, succeeded him. But there were many rivals in the field, among them Abdurrahman Khan, the present amir; and Shir Ali cannot be said to have been the undisputed ruler of Afghanistan before 1868. His attention was then directed to persuading the English, in return for valuable concessions, to guarantee the amirship to himself and his descendants, and also to supply him with funds with which to raise and maintain an army in the face of the unpopularity his reforms were arousing in Afghanistan. In this he was only partially successful; and in 1878 he turned to the Russians. Gen. Stolietoff was received at Kabul as ambassador, and Gen. Grodekoff was escorted through Afghan Turkestan to Herat, while the English envoy was not even allowed to cross the frontier. War followed; and in a few months Shir Ali died a fugitive at Mazar-i-Sharif. His second son, Yakub Khan, was recognized by the English as amir; and, upon his signing the treaty of Gandamak in 1879, the English evacuated the country. By this treaty the foreign relations of Afghanistan were placed under the control of the English, who were to be allowed to send a 'resident' to Kabul. Shortly after his arrival, Major Cavagnari, the 'resident,' was murdered. The English again invaded the country, deposed Yakub Khan, and recognized his cousin, Abdurrahman Khan, for many years an exile in Bokhara and Samarkand, as amir. Kabul was evacuated in 1880, and Kandahar in 1881. In 1883 the new amir drove Ayub Khan, another son of Shir Ali,

out of Herat, and became sole ruler of Afghanistan.

North of the Hindu Kush, and between that range, the Oxus River, and the Turkoman Steppe, are situated Badakshan and Afghan Turkestan, as the provinces of Kunduz, Khulm, Balkh, Sir-i-pul, Shibirkhan, Andkhui, and Maimana are conveniently called nowadays. The great mass of the population belongs to the Usbeg race, who are of the same Turki stock as the Usbeg inhabitants of Russian Turkestan. The best account of this part of the world, in recent times, is 'Gen. Grodekoff's ride from Samarkand to Herat,' translated from the Russian by the indefatigable Charles Marvin.

Before 1872, Balkh, near the ruins of the ancient Bactra, was the capital of Afghan Turkestan. But in that year the cholera raged there with such virulence that the seat of government was removed to Mazar-i-Sharif, a few miles to the east, where is situated, according to the Usbegs, the tomb of Ali. Balkh is now an insignificant village. Gen. Grodekoff spent a couple of weeks of enforced idleness at Mazar-i-Sharif in 1878; and to his Russian eyes the Usbegs seemed ready to fall into the arms of the czar, the advance of whose armies, however menacing to Afghanistan and India, has certainly brought order and law to central Asia, and especially to the Usbeg countries of Bokhara and Khiva. Almost nothing is known of the condition of the country at the present time; but the Usbegs assisted Abdurrahman Khan in his struggle against the sons of Shir Ali. That they are more trusted by the Kabulites now than in 1878, is shown by the fact, that, while they were then disarmed, an Usbeg corps formed part of the amir's escort to the recent conference at Rawal Pindi.

The origin of the Turkomans is veiled in obscurity; but it may be stated as certain, that in 1830 the Tekke Turkomans occupied the Akhal oasis, the Sarik Turkomans lived amidst the ruins of Merv, and the Salor Turkomans resided in and around Sarakhs. They were all robbers and slave-stealers, but the Tekkes seem to have been by far the most savage and energetic. They flourished, and outgrew the capabilities of the Akhal oasis. A portion split off, and, advancing to the east, settled down on the Tajand. The Persians, in 1833, fell upon the Salors at Sarakhs, and all that escaped took refuge among the Sariks at Merv. The Tekkes then moved on to Sarakhs, and, as they gradually acquired strength, extended their forays to Khiva, Bokhara, and to every part of Persian Khorassan. This

brought upon them the vengeance of the Persians, who, in 1857, drove them from Sarakhs to Merv. As there was not room on that oasis for such a large population, the Tekkes compelled the Sariks to move farther up the Murgháb. They established themselves at Yulatan and Panj Deh, driving out the Salors, and according to the Russian general, Petrusevitch, some Afghan nomads who fed their flocks near the latter place. The Tekkes, now masters of Merv, built an enormous dam at Benti, and by means of lateral canals greatly increased the cultivable area of the oasis, until it became capable of supporting a population of not less than a quarter-million souls. From this secure retreat, the Merv Tekkes raided the frontier provinces of Persia and Afghanistan, until whole districts became desolate. In 1861 a Persian army thirty thousand strong, accompanied by artillery, was sent against them; but instead of defeating the Merv Tekkes, the Persians were overthrown, and fully one-half captured and sold into slavery by the Mervli. After the Russians had brought Khiva and Bokhara under their dominion in 1873, they abolished slavery in those places, and, by closing their great slave-markets, took away from the Tekkes the incentive to the capture of slaves.

The ground put forward by Russia to justify her occupation of Panj Deh and Sarakhs is now clear; that is, if we allow that the Sariks were tributary to the Merv Tekkes. Those of Yulatan undoubtedly were; they could not very well help it, living as they did on the oasis. But the case is not so clear as to the Panj Deh Sariks, who, according to the English and Afghans, pay tribute to Herat. The Russians reply that no tribute is paid except at the point of the bayonet, and therefore, on ethnological grounds, Panj Deh should go with Merv. That compulsion is necessary, is certainly true. It is admitted by the Afghans. But the soldier is the tax-gatherer not only of Panj Deh, but of central Asia. In conclusion, it will not be amiss to again point out that all of Afghanistan north of the Hindu Kush and its outlying spurs belongs, both geographically and ethnographically, to Russian Asia, rather than to Afghanistan.

EDWARD CHANNING.

#### THE LEGAL LANGUAGE OF INDIA.<sup>1</sup>

IN the higher courts of justice and in government administration in Calcutta, Madras, and Bombay, the English language is coming into general use. In

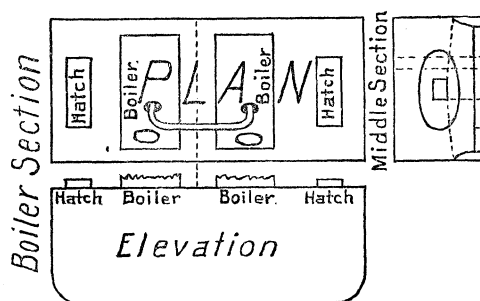
<sup>1</sup> Translated from the *Oesterreichische monatschrift für den orient.*

the courts, both written and spoken proceedings are in English. In the examination of native witnesses, and in the reading of documents in the native language, the judges are allowed interpreters. In other parts of India, however, the provincial language is used, both in legal and in government transactions: thus, in Bengal, the Bengalese is employed; in Behar and the north-western provinces, the Urdu and Hindu dialects; in Madras, the Telugu and Tamil; the official language varying in accordance with the dialect used in each province. In law cases the magistrates have the privilege of declaring which dialect is to be considered legal. English-speaking officers (either Englishmen or natives) can use English in rendering their judgments, etc.; but they must be perfectly familiar with the native tongue, and use it in intercourse with the parties. Everywhere in the cantons, schools are organized in which elementary instruction in the provincial dialects is given: in all the more important places there are schools in which English is taught; and there are a smaller number of colleges in which those higher branches, usually taught in English high schools and colleges, may be studied. Besides these, there are a considerable number of colleges especially devoted to the study of eastern dialects. In this class are the midrassi (Mohammedan theological high schools, in which philosophy and science also are taught), and Sanskrit colleges and schools, a considerable number of which are at present encouraged and supported by the government. The use of the native dialects has always been encouraged by the English government; and in reference to this there has never been any agitation among the native population. But there are numerous associations with the declared purpose of protecting the interests of the natives; and thus it happens that the wishes of government which are in accord with the existence and spread of education among the natives, are at times supported by these associations. Petitions and presentations may be drawn up either in the official dialect of the province or in English. In reality, documents of this kind always receive consideration, whatever language is used.

#### HAULING A STEAMER THROUGH AFRICA.

FROM letters of one of the agents of the International African association, we gather the following account of the transportation of the steamer *Le Stanley* along the banks of the Kongo from the Atlantic to Stanley Pool. As the rapids in the river necessitated the hauling of this craft over the land, she was divided into nine sections, about eight feet by sixteen, each of which was mounted on a heavy iron wagon, especially designed for the purpose, which required, through the roadless country on level ground, some eighty Zanzibaris each to haul them. It will readily be understood that in such a hilly country considerable difficulty was to be met in managing these wagons; and the transportation has

not been effected without many accidents. As many as twenty per cent of the men were generally incapacitated for work by broken limbs, or wounds, though only two were actually killed. This is a very small proportion, when the dangers are considered to which these fellows were exposed, which can be best imagined when one thinks of a wagon of iron, loaded with several tons of the same metal, running down a steep hill, almost or entirely beyond the control of its attendants. This down-hill movement was only attempted with some fifty men in front, and two hundred behind, exerting all their strength to check the speed. The negroes would always stand by the wagon as long as a white man did; but the minute their white superintendent or commander had let go, they followed his example with alacrity. The wagons were steered by three of the Zanzibaris, who, strange to say, always escaped, very possibly owing to their superior agility. On one of the down-hill movements, when a wagon got entirely beyond control, the wheels were broken off, and one was found sticking in the mud, but another was never seen again.



The steamer, which by this time is probably finished, is a clumsy affair, of great beam and light draught, about sixty-nine feet long. A clear idea may be obtained of the form of the vessel from the accompanying plans of the section containing the two boilers. When finished, the steamer will be eighty feet six inches long, including the wheel, which is at the stern; and about the same beam throughout, excepting at the bow, which is of course tapering. The boilers are placed at the bow; and the machinery at the stern, acting directly on the paddle-wheel, eight feet four inches in diameter. *Le Stanley* is not a beautiful boat, but will serve a good purpose on the Kongo, where there were only a few steam-launches before her completion. Her capacity is large, and, when loaded, she draws only two feet of water.

#### THE EFFICIENCY OF THE STEAM-ENGINE.

THE results of a series of trials of steam-engines, tested without reference to the efficiency of the boiler, by Mr. J. G. Mair, and reported by him to the British institution of civil engineers,<sup>1</sup> will repay careful study

<sup>1</sup> Excerpts, lxxix. part i.

and unusually detailed discussion. Mr. Mair has been one of the earliest and most earnest advocates of this system of 'independent engine-tests,' and has followed closely upon the steps of Messrs. Farey & Donkin, and of Sir Frederick Bramwell, in carrying out this undoubtedly correct method.

By this system, the power of the engine, and the distribution and variations of weight of steam in the steam-cylinder, are determined by the indicator in the usual way; while, at the same time, the discharge of heat into the condenser of the engine is measured by introducing a weir at the discharge from the hotwell, and, by the use of properly disposed thermometers, calculating from the readings so obtained the number of thermal units of heat-energy thus carried away from the engine. The sum of the quantities of heat carried off, the heat converted into power and utilized as mechanical energy, and the heat wasted in various ways in its passage through the machine, should evidently be equal to the heat received from the boiler. The latter quantity is usually capable of easy determination; and the power of the engine as shown by the indicator, and the losses in the condensing water, are the other important quantities, and these are also readily ascertainable. The comparison thus made is that of the heat produced at the generator, with the power derived from it; and, this comparison being effected, it becomes easy to calculate, from the data thus obtained, what is the actual efficiency of the engine; what are the wastes, and in what direction they occur; and, finally, in what direction improvement may be looked for, and to what extent it is possible.

Mr. Mair's trials were made with several engines, and in some cases with the same engine under varying conditions. Of the engines tested, one was a single-cylinder beam-engine, one was a 'Bull-Cornish engine,' and the others were Woolf arrangements of the compound engine. With the first of these engines, steam was carried at from 56 to 59 pounds' pressure, measured from vacuum. The speed of piston was from 222 to 240 feet per minute, and the ratio of expansion varied from 2 to 4.33. The steam used was practically dry, containing, by observation, but one per cent of water. The amount passing through the jacket was from 4.4% to 4.9%, except on one occasion, when the jacket-steam was entirely shut off. The power of the engine was from 120 to 125 horse-power, as shown by indicator.

The proportion of water condensed in the cylinder, up to the point of cut-off, varied from 15% to 30%, as the ratio of expansion increased from 2 to 4.33, and was brought up to 37% at the ratio 3.84 by shutting off the jacket. The heat supplied to the engine, measured in British thermal units, varied from 416 to 516 per horse-power per minute; the best work being done, and most economy exhibited, at a ratio of expansion of 3.16. When the jacket-steam was shut off, the consumption of heat amounted to 516 units per minute. The consumption of steam amounted to from 21 to 26.5 pounds per horse-power per hour. The theoretical efficiency was from 25% to 27%, while the actual efficiency was from 8% to 10%, or from 33% to

37% of that estimated on the assumption of perfect freedom from wastes other than the necessary thermodynamic waste of the perfect engine.

Comparing these figures, it will be seen that the cylinder waste amounts, in this engine, to about ten or twelve hundredths the ratio of expansion, in percentage of the total heat or steam supplied in the cases of trial of the jacketed cylinder. Throwing off the jackets brings up the waste to a percentage equal to nearly fifteen-hundredths the ratio of expansion.

The 'Bull-Cornish engine' is a pumping-engine in which the steam-distribution is effected as in the ordinary Cornish engine; but the beam is dispensed with, and the cylinder is inverted and set directly over the shaft and pump-rod. It is thus impossible to use safely as large a ratio of expansion as in the common form of Cornish engine, the distribution of weights being less capable of a wide range of adjustment. In this case, the engine was worked with 55 pounds' absolute steam-pressure, at a piston-speed of 244 feet per minute, using dry steam at a ratio of expansion of 1.75. In this case, the amount of condensation at cut-off was 17%; the power was 175 horse-power; the heat used was about 624 thermal units per minute, and the steam 32 pounds per horse-power per hour; the theoretical efficiency was 23%, the actual 7%, and the latter was 30% of the former. The 'Bull-Cornish engine' is thus seen to be substantially equal to the single-cylinder, jacketed beam-engine in waste by condensation, but, on the whole, to be inferior to the latter in its consumption of heat and of steam under substantially equivalent conditions.

The Woolf compound engines were worked with steam varying from 67 to 78 pounds' pressure, absolute, with piston-speeds from 284 to 368 feet per minute, and at ratios of expansion varying between 10 and 16.5. Their power ranged from 133 to 215 horse-power, and the amount of heat supplied ranged from 296 to 324 thermal units per horse-power per hour. The cylinder-condensation ranged from 24% to 31%, or about eight times the square root of the ratio of expansion, in per cent, of steam supplied. The engines used from 15.12 to 16.6 pounds per horse-power and per hour. The efficiencies, theoretical and actual, were from 25% to 30%, and from 13% to 14%; the latter quantity being nearly one-half the former. The consumption of steam, on these trials, is extraordinarily low, — the lowest on record, probably, — and should be checked by repeated experiment.

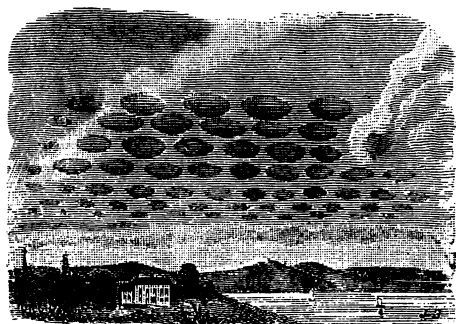
On the whole, these reports present the class of data that the engineer greatly needs, both for the purpose of determining the direction and the limitations of further improvement of the steam-engine, and for the purpose of securing a more practically applicable theory of the real, as distinguished from the ideal heat-engine.

R. H. THURSTON.

#### METEOROLOGICAL NOTES.

THE Russian meteorologist, Woeikof, known in this country from his share in the final preparation

of Coffin's great work on the winds of the globe, is one of the most industrious, as well as one of the best, writers among the modern meteorologists. He has lately published a good-sized volume on climatology, in Russian, from which a sample chapter on the influence of forests is translated in a recent number of *Petermann's Mittheilungen*, to which we shall shortly refer. Besides this, the German and Austrian journals of meteorology contain frequent contributions from his study devoted largely to the discussion of the climate of the eastern dominions of Russia. Among these, that on the climate of East Siberia contains many facts of interest, especially in relation to the extremes of winter cold observed at Yakutsk and other low inland stations, where the average January temperature is close about the freezing-point of mercury. It is found that the excessive cold that characterizes the long, clear, quiet winter nights of that region is most severe in the low valleys, while the elevated stations have a distinctly milder winter, although still surely cold enough; so that at this season the air is generally warmer at a moderate altitude above the earth than at its surface. This inversion from the normal decrease of temperature vertically, had already been inferred by Hann to be a characteristic of the cold season of continental interiors, but its best observational proof is now given by Woeikof. It results directly from the ease with which the land cools by excessive radiation in winter, while the air which is slower to lose its warmth departs less from its average annual temperature. An example of a similar condition in this country is given in an account of the cold island in Michigan, by Alexander, in a late number of the *American meteorological journal*.



CLOUDS SEEN IN MEURTHE-ET-MOSELLE.

Millot, secretary of the Meteorological commission of Meurthe-et-Moselle, describes in *L'Astronomie* some very singular clouds which he observed in the morning of Dec. 18, 1882, directly after a rain-storm and severe squall from the west. Scattered equally throughout the pallio-cumulus rain-clouds were hemispherical grayish pockets slightly elongated, which Millot calls globo-cumulus clouds. They are represented in the accompanying cut.

Elfert, in his paper on cloudiness in central Europe, presents statistics of cloudiness from three

hundred and nineteen stations scattered generally throughout western Europe between latitudes  $39^{\circ}$  and  $60^{\circ}$ , and longitudes  $4^{\circ}$  and  $30^{\circ}$ . The stations range in height from near sea-level up to nearly nine thousand feet above. The periods of observation vary from one year to forty or more, and few stations have been occupied for a less period than three years. Statistics of the monthly, seasonal, and annual percentages of cloudiness are given for all these stations, showing a mean percentage of cloudiness in central Europe, in winter, of 69; in spring, of 59; in summer, of 55; and in autumn, of 64. The mean of the year is 62%. Over the greater part of the area under discussion, the maximum of cloudiness is reached in winter, and the minimum in summer; but in the alpine region these conditions are reversed, while in the low region of Holland and Belgium the maximum is in spring, and the minimum in the autumn. The distribution of the annual cloudiness shows little appearance of design, further than the general fact that cloudiness is more general in the northern than in the southern part of the area. The general tables are succeeded by discussions concerning the relations of relative humidity and of the direction of the wind to degree of cloudiness, and of the relative proportions of cloudiness at different times of the day. The paper is illustrated by maps and diagrams.

#### THE RUSSIAN EMBASSY TO AFGHANISTAN.

THE origin and growth of the present Russian empire are intimately connected with the courses of the great rivers of Russia. Between the White Sea and the Pontus Euxinus, the Baltic and the Caspian seas, the country, totally devoid of dominating elevations, bears the character of an extensive lowland, stretching towards the south. Orographically it may be considered as the continuation of the plains of central Asia, with which it is connected. Over this tract of land various Slavonic tribes, the present Russians, have been spreading at a more or less rapid rate, especially in a south-eastern direction. Subjugating those who offered resistance, they ever remembered the words, 'to conquer, or to perish,' — the proud device of Swätosloff, their first great leader. Unlike the bloodthirsty Asiatic warriors, themselves an agricultural people, they were the bearers of civilization, whether they moved toward the north, east, or south. In some directions their progress necessarily had to be slow; but it has steadily been going on for the past two thousand years.

*Reise der russischen gesandtschaft in Afghanistan und Buchara in den Jahren 1878-79*, von Dr. J. L. JAWORSKI. Aus dem russischen übersetzt und mit einem vorwort und anmerkungen versehen, von Dr. ED. PETRI, docent für geographie und anthropologie an der universität Bern. Bd. I. Jena, Costenoble, 1885. 12+427 p., illustr. 8°.

It is not difficult to comprehend the motives by which, in 1869, Russia was prompted to send her troops across the Caspian Sea; and it is likewise easy to perceive why, nine years later, she sent an embassy to Afghanistan, whose voyage is partly described in the volume now before us. The person intrusted with this mission was Major-Gen. N. G. Stolletoff of the imperial army. His command consisted of twenty-two Cossacks, a colonel, a topographer, three interpreters, and a physician. The latter, Dr. Jaworskij, who also performed the duty of historian, some time ago published two short volumes in Russian, containing the results of his observations. The first volume of this work has just been issued in a German translation.

Similar to other previous travellers, who have been visitors rather than explorers, the members of the embassy followed a single track, the shortest from one important point to the next, leaving the country to right and left unvisited. At the time the voyage was undertaken, the existing maps of the country had been mostly compiled from rough and unscientific observations. They were necessarily incomplete: places were located miles from their true position, rivers were running up hills, and mountains were set upon plains. Unlike most of his predecessors, Dr. Jaworskij, evidently accustomed to observing, had eyes to see, and ears to hear; and his descriptive power is certainly not of an inferior order. As a physician, he had rare opportunities to observe the family life of the various tribes through whose dominions the track of the embassy passed, and to study habits and customs which would probably escape the notice of the ordinary traveller. We watch him with true pleasure, making his preparations at Tashkend, the place from which the embassy started. We follow him to Samarkand, and thence to Dsham. We get acquainted with the genuine hospitality of the Bokharians, with the mode of life of the members of the embassy while at Karshi, and the ceremonies accompanying the receptions given by the emir of Bokhara. Leaving Karshi, the travellers wended their way across the steppe, to Amu Daria. While attempting to cross the river bearing the same name, they met with serious difficulties, as the Afghans would not permit them to land on their native soil. This obstacle, however, was soon overcome: they were made at home by the officials of Amu Daria, and received a military escort of three hundred men to take them across the desert to Mazár-i-Sharif, where they were welcomed by the serdar, at the head

of several regiments of soldiers. Notwithstanding all the precautions taken, most of the Russians suffered severely from the local malarial fever, which induced them to leave their quarters sooner than their suspicious hosts had originally anticipated. Accepting an invitation, tendered them by the emir Shir-Ali-Khan, to come to Kabul, they set out for that place after a fortnight's sojourn. Kabul was to be the terminus of their voyage.

Passing the valley of the Amu Daria, of which the author gives a graphic description, which may be considered a brief monograph, the travellers followed the banks of the Khulm. They then moved through Dere-i-Sendan, termed a glen in the narrative, but which, according to the account (p. 231), appears to be a regular extensive cañon, with perpendicular walls of an average height of about five hundred feet. Unfortunately, Dr. Jaworskij does not seem to have paid much attention to the geological features of the country traversed, for his observations in this respect are more than meagre. To go into the interesting details of the voyage to Kabul, would exceed the limits of these columns, and we therefore have to refer the reader to the volume itself. It may suffice here to state that the first mountain pass crossed on the way to Bamian was that of Tshembarak; but we cannot omit mentioning the description of the vast caves in the Bami-an valley, and the colossal stone images, representing human figures, which adorn their entrances. These rude statues, hewn out of the native rock (a conglomerate, according to the author), with which they are still connected by their backs, vividly remind us of the sculptures of Easter Island. They are represented on the plate facing p. 280. The entrances to the caves open between the legs of these images, which are loosely draped, and whose sex remains doubtful. It would be of interest and importance to unveil the true character of the dark round spots scattered over the apparently perpendicular and projecting narrow surface, which reaches from the ground almost to the broken-off elbow of the largest figure on the above-named plate. Until better informed, we should feel inclined to consider them as so-called cup-cuttings.

Having traversed the Sefid Khak, the last mountain pass to be crossed, the embassy, on approaching the goal of their voyage, were met by a vesir, who gave them a warm, brotherly welcome. He embraced the general and his officers, placed his saddle-elephants at their disposal, and escorted them to Kabul, where spacious quarters had been provided for them by

order of the emir, who sent word that he would be happy to receive them. The day following the friendly reception, the Russian ambassador examined the presents sent by the governor-general of Turkestan to be delivered to the chieftain, and found to his great dismay that they consisted of almost worthless things. According to the author, they were shabby to behold, and beyond the most indulgent criticism. Gen. Stolettoff, anxious to prevent the reputation of his country from being damaged by a fraudulent governor, selected three of his best horses given him by the emir of Bokhara. He had them provided with richly ornamented Bokharian saddles, with brocade blankets, and the officers cheerfully added their silver tea-set, most of their plate, some costly fire-arms, and various other valuable objects. The emir graciously accepted these gifts, sending in return 11,000 rupees, which, after some remonstrance, had to be accepted by the Russians in order not to offend the princely donor.

During their sojourn at Kabul, two events of importance took place. The heir to the throne of Afghanistan died after an illness of only a few days. In consequence thereof, the paragraph in the projected Afghano-Russian convention, that "the imperial Russian government recognizes Abdullah-Dshan as heir to the throne of Afghanistan," was changed as follows: "The Russian government is ready to recognize as heirs such persons as may be nominated by Emir Shir-Ali-Khan."

Shortly afterwards the emir received the unexpected message that an English embassy was under way to pay their respects to him, and that he should receive them "according to the usage of hospitality becoming to a good neighbor of India." This piece of news was surprising, for two years previous the emir had entirely fallen out with the English. Under these conditions, he could by no means receive the embassy. Like a good diplomat, he used the recent death of his son as a pretext, and informed them that he was in mourning; but to no effect. The English insisted upon being received. After holding a consultation with the Russian general, he sent them the only possible answer: he emphatically declined to receive them.

On the 11th of August, Gen. Stolettoff, accompanied only by the author and a number of Cossacks, suddenly left Kabul. Twenty days later, they again reached Samarkand, after an absence of almost fifteen months. The rest of his staff had been directed to remain at Kabul to await further orders.

We regret that we can dwell no longer upon this interesting and timely work, but we hope that we shall soon have an opportunity of reviewing the second volume, which has not reached us. We wish the translator might have displayed a little more artistic taste. That he has performed his work with minute correctness, cannot be denied; but his German style is by no means elegant. Sentences like the following, — '*Ich wollte furchtbar schlafen,*' or '*Sie werden sich zerschlagen*' (p. 137), — remind us too vividly of the idiom used by Señor Pedro Carolino in his 'English as she is spoke.' It is true that he states in his preface that he had attempted to render his translation as correct as possible; but we are far from even admiring the language of his introduction. We are, however, indebted to him for a better track-map than the one in the original, though the orthography of the names in the text does not always agree with that on the map.

#### THE RUSSIANS AT THE GATES OF HERAT.

No higher compliment could be paid to Mr. Marvin's little book than the fact, that, within ten days after it appeared, it formed the basis of leading articles on the Afghan dispute in nearly all the principal papers in the country, and in most of them without any acknowledgment. No one but a man who had made a most careful study of the subject could have condensed so much, and such timely, information in such small space and on such short notice. The preface bears the date of March 23; and the book gives the clearest possible insight into the progress of Russia's advance from the Caspian during the last few years, the purpose and aim of her movements, the origin of the boundary dispute, and its condition on the date named. With the aid of this book, the telegrams in the daily papers become clear and intelligible, and any one can follow the development of events hereafter with a clear understanding of them.

Mr. Marvin has passed a considerable part of his life among the Russians, and understands their language. While he is naturally alarmed at Russia's progress, and opposed to her intentions, yet he writes in a calm and moderate tone. He always strives to be just, and comes as near being so as is possible when one is a party to a controversy. In his inter-



course with the Russians during the last five years, he has gained a clear conception of what is the real object of Russia's advance across central Asia, and he is the first to explain it in the English language. It can be summed up in the phrase of Gen. Skobelev: "Russia does not want India, she wants the Bosphorus." It is England that maintains the Turk on the Bosphorus, and prevents Russia from taking it: hence Russia seeks a position from which she can threaten England with disaster, if she continues her opposition; and this position is on the frontier of India. To suppose that any body of Russians has ever seriously contemplated the conquest of India, is a mistake; but it is a fact, that the great mass of the Russian army firmly believes that England holds India by a feeble tenure, that a small force of Russian troops could cause an uprising in India which would overthrow the English rule, and that, when Russia possesses certain points on the Indian frontier from which it can injure the English, the latter will come to terms about the Bosphorus. These ideas first began to spread in Russia after the Crimean war, but they received a tremendous accession in consequence of the action of England in 1878. Their chief advocate was Skobelev, who had taken part in several of the campaigns in central Asia, and was marvellously familiar with the Asiatic question in all its bearings.

In pursuing this advance to the borders of India, Russia has acted on two lines; and Mr. Marvin dwells at length upon this fact, so as to avoid the confusion which vague notions of geography have caused in England. The first line, which was followed from 1863 to 1876, was from Orenburg south-eastward across Turkestan. This movement practically ceased with the conquest of Khokand or Ferghana, and the virtual subjugation of Bokhara in 1876. It gave Russia a territory about as large as France, Germany, and Austria combined, added something to her trade, and brought her armies to the base of the lofty mountains in the eastern part of Afghanistan, and only 300 miles from the north-west provinces of India.

The second movement began in 1879. Its starting-point was the eastern shore of the Caspian (about a thousand miles south of Orenburg), where Russia had gained a foothold ten years before. It has progressed, with extraordinary rapidity, eastward through Turkmenia, or the country of the nomad Turkomen, lying between Persia and the desert on the north. It reached Merv, six

hundred miles from the Caspian, in 1884; and this year it was nearing Herat, when the English took alarm, and endeavored to fix a limit by marking the boundary of Afghanistan as the line which could not be crossed except as an act of war.

These two movements have therefore attained their full development; and the object of them is accomplished, for Russia is now practically on the borders of India, ready to strike a vigorous blow whenever the moment seems propitious. She has a line of railway and steamboat all the way from St. Petersburg and Moscow to a short distance behind her advance post at Panj Deh; and she can move half a million men against Herat with far more ease and safety than she moved them into Turkey in 1877. And from Herat there are no physical obstacles to prevent a march on India; for, according to Mr. Marvin, one can drive a coach and four all the way.

This is in brief the situation of affairs to-day, as delineated with the utmost lucidity in Mr. Marvin's excellent little book. He accuses Russia of bad faith in her movements: so have France and other nations accused England in the past, until 'perfidious Albion' has come to be a by-word. Such accusations, and the arguments in support of them, count for little with disinterested spectators. What they desire to know are accomplished facts, and it is in the presentation of these that the merit of this book consists. Few people, even among those who have tried to follow this trans-Caspian movement, have realized what it has already accomplished, and how pregnant it is with great events for the near future. What was scouted in parliament only four years ago as an idle dream, is to-day a reality, an existing state of affairs. It finds the English unprepared, undecided, bewildered, as to their proper course. In front of them is a nation which they have succeeded in converting into their inveterate enemy, patient, crafty, determined, with a clear understanding of its own intentions, and a willingness to make any sacrifices in support of them. If England will agree with her about the Bosphorus, Russia will be at peace, and even retire from central Asia: if not, a terrible war must ensue, not necessarily now, but in the near future,—a war in which all the advantages of position will be on the side of Russia. The probable result of such a war is a matter of the widest speculation, and no one can foretell it. It is enough now to know and understand the existing state of affairs, and this Mr. Marvin has enabled us to do.

## TIFLIS AND BAKU.

AFTER having laboriously waded through half a dozen of the ponderous tomes with which English travellers—and American too, for that matter—conscientiously afflict mankind, it is really a pleasure to take up this light, and we fear ephemeral, narrative of the exploits of Mr. Orsolle. To be sure, there are few dates and no statistics in the volume. Neither are there any pictures, not even a portrait of the author. There is a map, but as it was evidently drawn to illustrate a condition of affairs considerably anterior to our author's journey, and as no attempt seems to have been made to adapt it to the book it accompanies, it is of little use; nevertheless, it is a good map, in its way, and, a few years ago, might have been regarded with a more favorable eye.

It was in July, 1882, that Orsolle said good-by to his mother, and made the best of his way to the 'gare du nord,' where his travelling companion, M. Ad. Nihlein joined him. Thence by Cracow, Odessa, and Sebastopol, he proceeded to Poti, where he arrived on the 14th of August. From Poti, at that time the Black-Sea terminus of the Caucasus railway, he journeyed to Tiflis. His description of the latter place occupies a dozen pages, and will well repay a cursory perusal. At Tiflis he left the railroad, and travelled in the manner of the country, which he found much more agreeable than did O'Donovan, to Kars, the ruins of the ancient city of Ani, of which a plan is given, and Erivan. Thence, by a route not to be traced on the 'Carte pour le voyage de M. Orsolle,' he found his way to the Tiflis-Baku railway, and eventually to the Caspian itself.

There are many descriptions of Baku in the books, but none so interesting as this. M. Orsolle does not tell us how many gallons of oil are refined per hour, nor does he go into the details of the use of the refuse products of that distillation on the Caspian steamers. He gives no information on such points; but he does tell us what Baku is like, who its denizens are, and how they eat, drink, play, bathe, and exist. We say exist, because, judging from this description, it is a bare existence that the Bakunians lead in their naphtha-soaked town, which, he says, is destined to become the Marseilles of the Caspian.

The remainder of the book is devoted to Teheran and north-western Persia, and possesses no especial interest at the present time.

*Le Caucase et la Perse.* Par E. ORSOLLE. Paris, Plon, 1885.

## NOTES AND NEWS.

THE following is a complete list of the papers read at the meeting of the National academy of sciences, April 21–24:—J. S. Billings and Dr. Matthews, U.S.A., Methods of measuring the cubic capacity of crania; S. H. Scudder, Winged insects from a paleontological point of view; A. S. Packard, The Syncarida, a hitherto undescribed group of extinct malacostracous Crustacea, The Gampsonychidae, an undescribed family of fossil schizopod Crustacea, The Anthracaridae, a family of carboniferous macrurous decapod Crustacea, allied to the Eryonidae; Alexander Agassiz, The coral reefs of the Sandwich Islands, The origin of the fauna and flora of the Sandwich Islands; T. Sterry Hunt, The classification of natural silicates; Elias Loomis, The cause of the progressive movement of areas of low pressure; C. B. Comstock, The ratio of the metre to the yard; C. H. F. Peters, An account of certain stars observed by Flamsteed, supposed to have disappeared; J. E. Hilgard and A. Lindenkohl, The submarine geology of the approaches to New York; Theodore Gill, The orders of fishes; J. W. Powell, The organization of the tribe; G. W. Hill, On certain lunar inequalities due to the action of Jupiter, and discovered by Mr. E. Neison, E. D. Cope, The pretertiary Vertebrata of Brazil, The phylogeny of the placental Mammalia; C. A. Young, Some recent observations upon the rotation and surface-markings of Jupiter; H. A. Rowland, On the value of the ohm; F. A. Genth and Gerhard vom Rath, On the vanadium minerals—vanadinite, endlicheite, and descloizite—and on iodyrite, from the Sierra Grande Mine, Lake Valley, N. Mex.; A. N. Skinner (by invitation), On the total solar eclipse of Aug. 28, 1886; Theodore Gill and John A. Ryder, The evolution and homologies of the flukes of cetaceans and sirenians; Ira Remsen, Chemical action in a magnetic field; A. Graham Bell, The measurement of hearing-power; A. Graham Bell and F. Della Torre, On the possibility of obtaining echoes from ships and icebergs in a fog. The following biographical notices of deceased members were also presented: of Dr. J. J. Woodward, U.S.A., by J. S. Billings; of Gen. A. A. Humphreys, U.S.A., by H. L. Abbot; and of William Stimpson, by Theodore Gill.

—At a recent meeting of the Bavarian geographical society, Professor Rutzel communicated some particulars concerning a map which he is designing to show the political circumstances of Africa; the actual limits of the various states, native and other, being defined according to the extent of the territories actually possessed by each. The map will show several 'centres' of state formation. The whole of the continent is, however, far from being divided amongst the existing tribes, as there are many districts which do not belong to any of them. The existing native states, moreover, such as the Sunda and the Zulu kingdoms, are of varying importance, and subject to very different systems. The native states, it is asserted, rest mainly on the boundary between the Sahara and the Sudan, the high plateau of east Africa, and the Guinea coast. The remain-

ing territories, so far as they are not occupied by European powers, are free from any form of state rule or possession.

—Bouquet de la Grye is ordered by the French ministry of instruction to proceed to Teneriffe, in order to study the laws of gravitation under all the circumstances for which the Peak offers facilities.

—Dr. Pechuel Lösche reports curious changes in the physical geography of Africa: "Lake Ngami is dried up; the game has died or gone away; the vegetation exists no longer; both the Okavango and the Tamakan flow into the Zambezi." Dr. Pechuel Lösche returns to Europe with rich collections, including a living *Welwitschia*, perhaps a new species of that curious plant.

—Dr. Lenz will leave Vienna in May for the upper Kongo, whence he will endeavor to cross the old equatorial province of Egypt in order to establish relations with Emir Bey and Lupton Bey's party.

—Dr. Silvers of Hamburg, who left that town in October, 1884, on an exploring expedition to the Cordillera of Merida in Venezuela, arrived at Tovar on Jan. 9, and from there will commence his explorations.

—The *Sémaphore de Marseille* reports a method of sugar-manufacture which is to supersede beet-root by potatoes, the saccharine matter being extracted by the help of electricity. Paris capitalists, and even English, are reported to be interested in the invention.

—The Marine biological association of England has already raised six thousand pounds of the fund required to found a station on the south coast of England, but requires four thousand pounds more before beginning to build. Cambridge has undertaken to raise five hundred pounds.

—A correspondent of the *Oesterreichische monatschrift für den orient* writes, that if the reports of the few parties who have succeeded in gaining personal knowledge of the interior of the celestial empire did not agree in the fact that a kingdom of four hundred million inhabitants awaits the products of European factories, which will be opened to commerce by the introduction of modern means of intercourse, the beginning of the development of European industries in the interior, as evidenced in the last few years, would awaken immediate and serious anxiety for the future of the English trade. Led by their position, Hong-Kong and Shanghai are setting a good example in this direction to the other places which come in contact with European civilization. Hong-Kong has at present three large sugar-refineries, a spirit-distillery, a cordage-mill supplied with modern machines, and an ice-factory. Besides these, there are large glass and iron works, and an arrack-distillery, in course of construction; while the Chinese carry on woollen and cinnabar works in great style and with modern improvements. In Shanghai, to the establishments which have existed for several years, there was added, a few months ago, a new one of considerable importance,—the paper-factory of the

Shanghai paper-mill company, which makes common and medium fine papers out of rags. This factory, established by Umpherston & Co. of Leith, and quite up to time in its plant, produces, on an average, two tons of paper a day; and later the production will be increased. It is under European direction, and employs only Chinese workmen.

—With a view to effectually prosecute marine fish-culture on sound scientific principles, the English national fish-culture association has under consideration a scheme for carrying out a series of observations on the temperature of the sea at various stages, in order to obtain a more thorough and concise knowledge of fish, their habits, food, etc. Thermometers for this purpose will be distributed to those selected for observers under certain rules and regulations.

—From experiments carried on by the French commission for the scientific study of firedamp, it is found that the most violent explosion takes place when there are 13 parts of air to 100 of firedamp, and that above or below this the explosion diminishes in violence. When the mixture is below 7 parts in 100, or above 18 in 100, the gas simply burns with its characteristic blue flame. The singing noise often heard in mines is ascribed to the escape of gas from many minute cavities; while it must exist in some places in vast quantities, as is witnessed by its use for illuminating-purposes.

—Prof. J. A. Ewing of University college, Dundee, has communicated a paper to the Royal society, which contains several points of immediate practical importance. He finds, for example, that the 'dissipation of energy' by reversal of magnetism is very much smaller in soft iron than in hard iron or steel, and even in the latter its amount is trifling; so that the principal part of the heat which is produced in the cores of electro-magnets must be due chiefly to other causes than the 'static hysteresis,' or static lagging action observed by Professor Ewing, and is, in fact, due almost wholly to the induction of so-called Foucault currents in the cores. The effects of this action are also almost entirely removable by vibrating a piece of soft iron during the application and removal of magnetizing force, and the iron is then found to possess almost no retentiveness; but, when the application and removal of magnetizing force are effected without mechanical disturbance, the retentiveness of soft iron is found to be even greater than that of steel. In some cases ninety-three per cent of the whole induced magnetism of a piece of annealed iron was found to remain on the complete removal of the magnetizing force. Examples were given to show that the influence of permanent set in the curve of magnetism is so marked as to give a criterion by which a strained piece may be readily distinguished from an annealed piece of metal; and that strain diminishes very greatly the magnetic retentiveness of iron.

—Capt. Hoffmann of the German navy has prepared a valuable pamphlet on ocean-currents (*Zur mechanik der meeresströmungen an der oberfläche der oceane*, Berlin, 1884), which gives a better

general presentation of theory and fact than any work we have seen. The value of the winds as the chief motive force, and the inefficacy of gravity brought into play by changes of temperature, are clearly made out, so far as surface-currents are concerned. The part played by the deflective forces coming from the earth's rotation is also well stated. So long as the surface-waters are brushed along by the wind in any given direction, the tendency to depart from this direction is practically overcome by the wind itself; but, whenever the waters set in motion by the wind enter a region of calm, they at once begin to describe the 'inertia curve,'—a line whose radius of curvature decreases with the sine of the latitude. Already in latitude  $5^{\circ}$ , this radius of curvature for a velocity of one metre a second is only forty-two and a half nautical miles: hence, when the South-Atlantic current runs into the region of calms just north of the equator, its waters will quickly turn to the right, easily falling into the power of the south-west monsoon of that region, and so forming the Guinea current, and, during the northern summer, the equatorial counter-current as well. The author therefore concludes, that, after the winds and the configuration of the coasts, the diurnal rotation of the earth must be recognized as the most important factor in determining the existing system of ocean-currents.

—Messrs. Sampson Low & Co. of London announce 'Under the rays of the aurora borealis, in the land of the Lapps and Kvaens,'—an original work by Dr. Sophus Tromholt, edited by Mr. Carl Siewers. The book contains an account of the work of the recent circumpolar scientific expeditions, and an exposition of our present knowledge of the aurora borealis, to the study of which the author has devoted the greater part of his life.

—The second session of the summer course of botany at McGill college, Montreal, will be opened to ladies on Tuesday, May 5. The course, which will be in charge of Professor Penhallow, will continue for seven weeks. It is designed to give practical instruction in general morphology, including the analysis and study of Canadian plants as found in the vicinity of Montreal. Instruction will also be given in histology with the microscope.

—In the annual report for 1884, of Prof. G. H. Cook, state geologist of New Jersey, there is a description of some remarkable recent changes in the condition of the land near South Amboy. A forest of common timber, such as oak and chestnut, standing on land ten or twelve feet above high-water mark, was cut down, and the underlying sands to a depth of twelve feet were stripped off preparatory to taking out the stoneware clays below; but, before reaching the latter, a swamp deposit a few feet thick, with white-cedar trees embedded in it, was passed through; and at the bottom of this, standing in the clay, were several oak stumps, at a level two feet below the adjacent salt-marsh, which is overflowed by high tides; and near the stumps there was a log about a foot in diameter, eight or ten feet long, that had been cut with an axe. There is no tradition telling of the

burial of this forest, but it must have been less than two hundred and eighty years ago. The successive deposits are well shown in the excavation. The clay at the bottom; the old oak forest in the soil on this clay; then the black swamp-earth, and its small cedars embedded therein; finally the overlying plain of sand and gravel, with its late growth of upland timber,—with this, there is good evidence that the ground, which was formerly high enough above the level of the sea to sustain a growth of upland timber, is now so low that every tide could cover it with salt water. Some valuable figures are given in illustration of the superposition of glacial drift on unconsolidated tertiary clays, and of the columnar trap-rocks and water-bearing sands. The Green-Pond Mountain rocks, which were thought triassic by Rogers, and which were regarded as Potsdam in the earlier reports of the present survey, are now placed in the middle Devonian. The crystalline rocks of the Highlands, which have been called Laurentian on the strength of their lithological characters, are here prudently called simply archæan, in the absence of sufficient evidence to correlate and identify them.

—Major-Gen. Sir F. J. Goldsmid has an article in the April number of the *Contemporary review* on Russia and the Afghan frontier. The gist of the article is, that the apathy with which the English government and people have hitherto watched the Russian advance from the Caspian towards India is due to a lamentable ignorance, on their part, of the geography and topography of central Asia. This is undoubtedly true; but how far the remedy proposed by the gallant general would be a remedy, is an altogether different matter.

—The Royal medals of the Royal geographical society, says *Nature*, this year were awarded to Mr. Joseph Thomson and Mr. H. E. O'Neill; to the former for his well-known work in Africa, and to the latter for his thirteen journeys of exploration along the coast and in the interior of Mozambique. The Murchison grant for 1885 was awarded to the Pandit Kreshna for his four explorations made while attached to the survey of India, and especially for his extensive and important journey in the interior of Tibet. The Back grant went to Mr. W. O. Hodgkinson for his Australian explorations, and the Cuthbert Peek grant to Mr. J. T. Last for his surveys and ethnological researches in the southern Masai, Nguru, and other neighboring countries. The following were made honorary corresponding members: Chief-Justice Daly, president of the geographical society of New York; Mr. Elisée Reclus, the eminent geographer; and Herr Moritz von Déchy, the distinguished Austrian explorer of the Sikkim Himalayas, the Caucasus, and other regions.

—On the night of the 5th of April, the steamship Nurnberg, in latitude  $49^{\circ}$  north, longitude  $18^{\circ} 30'$  west, during a very heavy storm from west-north-west, had mast-heads and yard-arms lighted with St. Elmo's lights. It was raining and hailing at the time, and the barometer showed 29.19. A ball of fire exploded during the storm, with a loud noise, similar to the explosion of a gun.